



Teacher skills and motivation both matter (though many education systems act like they don't)

For students to learn, teachers have to teach effectively—but many education systems pay little attention to what teachers know or what they do in the classroom. Focusing on teachers' skills and motivation can pay off.

After prepared and motivated learners, equipped and motivated teachers are the most fundamental ingredient of learning. Teachers are also the largest budget item, with their salaries accounting for over three-quarters of the education budget at the primary level in low- and middle-income countries.¹ Yet many education systems put in classrooms teachers who have little mastery of the subjects they are to teach—especially in classrooms serving poor children.² Once in place, most teachers take part in some professional development, but much of it is inconsistent and overly theoretical. Meanwhile, education systems often lack effective mechanisms to mentor and motivate teachers.³ Such failures can be illuminated through models of human behavior—which also point to solutions (table 6.1). A synthesis of the evidence in these areas reveals three principles that are key to achieving learning success through teachers:

- To be effective, teacher training needs to be individually targeted and repeated, with follow-up coaching, often around a specific pedagogical technique.
- To avoid learners falling behind to the point where they cannot catch up, teaching needs to be pitched to the level of the student.
- Increasing teacher motivation with incentives can increase learning if the incentivized actions are within teachers' capacity and if the failure to perform those actions has impeded learning.

Most teacher training is ineffective, but some approaches work

In-service professional development requires significant time and resources. A survey of 38 developed and developing countries found that 91 percent of teachers had participated in professional development in the previous 12 months.⁴ Two-thirds of World Bank projects with an education component in the last decade incorporated teacher professional development. Developing countries spend many millions a year to strengthen teachers.⁵

But a lot of teacher professional development goes unevaluated—and much of it may be ineffective. One team of teacher training experts in the United States characterized professional development in the country as “episodic, myopic, and often meaningless.”⁶ Teacher training in low- and middle-income countries is often short and of low quality.⁷ Countries often have many training programs under way at the same time—in some cases dozens—with little to show for them (box 6.1).

Though preservice teacher training is important in providing basic skills (box 6.2), evidence on teacher training credentials is mixed. Much of the limited evidence on teacher credentials, generally from high-income countries, indicates they have no or extremely

Table 6.1 Models of human behavior can guide actions to improve teaching: Some examples

Synthesis principle	Where this fails	Models that identify a mechanism behind this failure	Approaches that address the modeled mechanism
Provide individually targeted and repeated teacher training, with follow-up coaching.	Much teacher training is one-off, with little to no follow-up coaching in the classroom.	<i>Simple optimization (by government) with information failure:</i> Follow-up coaching is more costly than centrally delivered training, and centrally delivered training may give the impression of effectiveness by changing teacher knowledge but not practice. General pedagogical training may be cheaper than training in specific techniques, and evidence on relative effectiveness is recent.	In India, a program with limited preservice but repeated follow-up for community teachers led to sizable learning gains. In the United States, programs associated with a specific pedagogical technique were twice as effective as general pedagogical training.
Pitch teaching to the level of the student.	In many countries, most students fall far behind the curriculum, and, facing large, heterogeneous classes, teachers have difficulty teaching at a level that allows students to learn.	<i>Information failure:</i> Policy makers may have an imperfect understanding of how little many students are learning. <i>Behavioral (mental models):</i> Teachers may believe that lower-performing learners cannot succeed; curriculums may be optimistically pitched higher than most students can keep up with.	In India and Kenya, reorganizing classes by ability improved learning. In India, complementing teachers with dynamic computer-assisted learning programs that adapt to learners' ability levels improved math ability. Teachers receive explicit guidance to teach students at their level.
Strengthen teacher motivation by incentivizing actions that are within teachers' capacity and that are essential to learning.	In many systems, teachers have few incentives (financial or professional) for good performance beyond their intrinsic motivation.	<i>Principal-agent:</i> If the education system signals that learning is not valued, teachers will not have the same incentives as students and parents have.	Teacher financial incentives have been effective in countries with high absenteeism, such as India and Kenya.

Source: WDR 2018 team.

small effects on student learning.⁸ Simple statistical associations across francophone Africa suggest a positive relationship between teacher preparation and student performance, but that relationship could be driven by other factors, such as strategic placement of good teachers in desirable areas (where students would perform well in any case).⁹ Preparing teachers better is crucial, but the political economy challenges to doing so may be greater than for in-service training, and the evidence is more limited. The same principles that lead to effective in-service training serve as useful starting points for improving preservice training.

Is there hope for in-service training or professional development? Decidedly yes. Experience from high-income countries shows that practicality, specificity, and continuity are key to effective teacher professional development.¹⁰ Practicality means teachers are trained using concrete methods as opposed to theoretical constructs, and the training is classroom-based.¹¹

Specificity means teacher training programs are most effective when they teach pedagogy specific to a subject area (say, how to effectively teach a mathematics class). Continuity means teachers receive significant continual support—not one-off workshops.¹²

In teacher training programs, the inclusion of follow-up visits in school leads to higher learning gains. To bridge the gap between learning new methods in training and implementing them in practice, developing countries should make more use of follow-up visits in which trainers observe and support teachers in the classroom.¹³ In Africa, a range of programs with long-term teacher mentoring and coaching has shown sizable learning effects.¹⁴ In India, a program that provided little initial training to teachers but then provided support throughout the year significantly increased both math and language ability, with the largest gains for those students who were performing poorly at the outset.¹⁵ Teachers in Shanghai,

Box 6.1 The landscape of in-service teacher training

The quality of in-service teacher training varies dramatically across countries, but much of the training does not align with practices that are associated with better student performance.^a One good practice of in-service teacher training involves follow-up visits to teachers' classrooms to provide ongoing support. Among 100 teacher training programs

across five regions, the median number of follow-up visits is fewer than one per teacher. Many in-service training programs (50 percent among a sample of programs) evaluate their success based on teacher knowledge at the end of the training; far fewer (25 percent) seek to assess their impact on student learning.^b

Source: WDR 2018 team.

a. Popova, Evans, and Arancibia (2016).

b. Popova, Breeding, and Evans (2017).

Box 6.2 What works in preservice teacher training?

In New York City, teachers who participated in teacher education programs that focused on practical classroom work and on the curriculum of the first year produced significantly better results among first-year teachers than programs that did not.^a At the same time, systems that have introduced alternative routes to teaching—routes such as Teach for America or community-teacher programs that skip regular preservice education—have not reduced

learning for students.^b This finding calls into question the value of preservice training. However, the alternative routes often replace preservice education with more careful selection of teachers (such as in Teach for America) or with more performance-oriented contracts (such as those for contracted community teachers). Thus preservice education remains important for most education systems and will likely yield better results with more practical training.

Source: WDR 2018 team.

a. Boyd and others (2009).

b. Duflo, Dupas, and Kremer (2015); Glazerman, Mayer, and Decker (2006).

China—where performance is high by global standards—participate in ongoing Teaching-Research Groups, which provide development, mentoring, and peer evaluation based on classroom observation.¹⁶

Likewise, training associated with a specific pedagogical technique tends to be more effective. Across educational interventions in the United States, programs teaching a specific pedagogical method have more than twice the impact of programs focused on general pedagogy.¹⁷ Globally, specific guidance is crucial for low-skilled teachers, who may lack the ability to be effective even when motivated.¹⁸ At times, in settings where teachers have limited skills, this involves providing lesson plans that are highly scripted, outlining concrete steps for teachers.¹⁹ Many countries will protest that high-quality in-service professional development—repeated, with follow-up visits in school, often around a specific technique—is beyond their

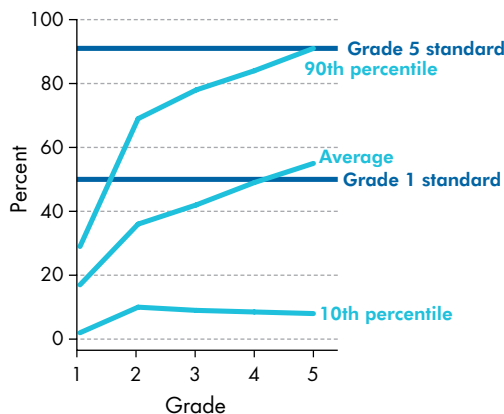
budget to deliver at scale. But teachers will not learn without receiving high-quality teaching themselves. A country facing this conundrum may be better served by delivering high-quality training in stages rather than ineffective training to all in the short run.

Helping teachers teach to the level of the student has proven effective

In many countries facing the learning crisis, it may be that only students who start at the highest levels of learning are able to keep learning. This is in part because teachers tend to teach to the most advanced students in a class.²⁰ These students are the easiest to teach, and when teachers solicit answers from students, the high performers are the most likely

Figure 6.1 Only a small fraction of learners keeps up with the curriculum

Probability of a correct answer on a math test, by grade, relative to curriculum standards, Andhra Pradesh, India



Source: WDR 2018 team, using data from Muralidharan and Zieleniak (2013). Data at http://bit.do/WDR2018-Fig_6-1.

to volunteer them. That leaves behind the students who entered the class with less knowledge. Indeed, Kenyan school dropouts identified that problem as a primary reason for leaving school.²¹ Another reason that many students fall behind is that in many countries the curriculum may simply be too ambitious.²² Teachers feel constrained to teach to the curriculum even when students have trouble keeping up.²³

A key principle in leaving no learner behind is to help teachers teach to the level of their students. This technique has been successful in different formats across a range of scenarios, whether by using community teachers to provide remedial lessons to the lowest performers, reorganizing classes by ability, or using technology to adapt lessons.²⁴ In many cases, it does not require a significantly greater teacher effort, but rather relies on restructuring classes or providing remedial lessons for the lowest performers. A related principle of effective instruction is to reach students by teaching them in their mother tongue (box 6.3).

Grouping students by ability may allow teachers to more effectively target teaching to the levels of students in their classes. The theoretical effects of such grouping are mixed. The positive effects of better-targeted teaching have a potential downside: the adverse effect for lower-performing students of no longer learning from their higher-performing peers. Furthermore, in early grades in particular, student ability is not always easy to measure, so separating students by ability can put students on the wrong track. Teachers may also reduce their efforts when

teaching the students in the lower-performing group, and higher-quality teachers may be assigned to the higher-performing classes because these students may be easier to teach and so the assignment appears to be a reward.

In school systems with very low learning levels, ability grouping has had positive impacts on both lower- and higher-performing students. In Kenya, grouping students into classes by ability led to improved outcomes across the board, with the highest impacts among learners with more motivated teachers.²⁵ In India, schools reorganized classes by group for just an hour a day and observed major gains in learning.²⁶ Much of the rest of the evidence comes from the United States. Studies that relied on a credible counterfactual found that grouping students by ability either helps some students or at least has no adverse impact.²⁷ In low-performing education systems, the lowest-performing students learn little to nothing (figure 6.1), so allowing teachers to target pedagogy may have a positive net effect.

Another way to help teachers teach to the level of the student is to help them conduct better diagnostics. In Liberia, an intervention that taught teachers to better evaluate their students was effective, especially when combined with training and additional materials. So was a similar program in Malawi.²⁸ In Singapore, students take screening tests at the beginning of grade 1, and those who are behind in reading receive additional support daily.²⁹ By contrast, an intervention in India that merely provided formative evaluation was not effective; nor was another program in India that provided diagnostic reports and written suggestions on how to use the reports to strengthen teaching.³⁰ Clearly, helping teachers to better understand their students' ability levels is worthwhile, but if teachers lack the tools to respond effectively or the incentives to do so—given that teaching students at multiple levels is challenging—then it may not be sufficient. The diagnostics can work where a system is in place to follow up, as well as where teacher motivation is less of a binding constraint (box 6.4).

New technologies offer promising ways to help with teaching to the level of the student. Computer-assisted learning programs can permit students to go at their own pace or adjust the level of instruction based on an initial screening test.³¹ More advanced software can not only screen students initially but also dynamically adjust questions based on ongoing performance. Although the overall evidence on computer-assisted instruction is markedly mixed, such a dynamic learning program among secondary school students in Delhi, India, led to striking gains in both mathematics

Box 6.3 Reaching learners in their own language

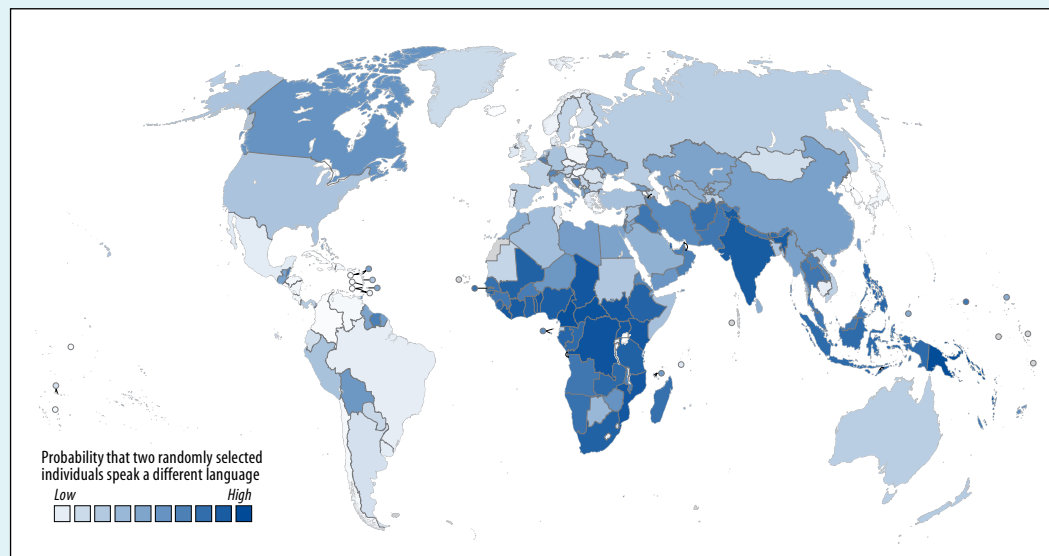
Children learn to read most effectively in the language they speak at home—their mother tongue. In Kenya, students in early grades had higher reading comprehension when their teachers had training and materials in mother tongue instruction.^a Students participating in a pilot in rural Philippines, where they received instruction in their local language, showed significantly higher reading and math scores than students in traditional schools, which used English and Filipino.^b In Ethiopia, students in schools affected by a reform to implement mother tongue instruction were subsequently more likely to be in the appropriate grade for their age.^c Beyond its direct learning impacts on them, students receiving instruction in their mother tongue are more likely to attend and persist in school, as demonstrated by data from 26 countries.^d

The increased skill from learning to read in mother tongue can translate into greater skill in a second language. Parents and policy makers sometimes object to mother tongue instruction on the grounds that the mother tongue is not a practical language for the labor market. Yet in South Africa, students instructed in their mother tongue in early grades actually performed better in English proficiency in later grades.^e Likewise in pilot interventions in Malawi and the Philippines, students instructed in their mother tongue

also performed better in English reading later on.^f On the other hand, results from a first-language program in Kenya do not show better outcomes in the second language compared with a second-language literacy program only (though the program lasted only one year).^g

But in countries with many languages, mother tongue instruction can be overwhelming to implement, and a language “mismatch” can result in learners being left behind. Filipinos speak more than 180 different languages, Kenyans speak more than 70, and Peruvians speak nearly 100. In 98 countries worldwide, the chance that two randomly selected individuals speak the same mother tongue is under 50 percent (map B6.3.1).^h In communities with a dominant language group, the choice of that language for mother tongue instruction may marginalize minority children. Even in countries with few languages, teachers generally have little training in mother tongue instruction, and the materials available for mother tongue instruction may be limited and of lower quality than materials in the lingua franca.ⁱ In communities with multiple mother tongues, schools may divide classes by mother tongue, but this division can act as segregation.^j Mother tongue instruction may be an unambiguous benefit for countries with a limited number of mother tongues, such as Burundi or Haiti, but the initiative still involves a major

Map B6.3.1 Linguistic diversity around the world



Source: WDR 2018 team, using data from Ethnologue (2015). Data at http://bit.do/WDR2018-Map_B6-3-1.

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Box 6.3 Reaching learners in their own language (*continued*)

investment in materials and teacher training. In more diverse locales, governments will need to weigh the gains and the costs associated with mother tongue instruction against those of competing investments in higher-quality education

overall. In some cases, they may opt for better-selected and better-trained teachers who receive more support in teaching students at their level, regardless of the language they speak.

Source: WDR 2018 team.

- a. Piper, Zuilkowski, and Ong'ele (2016).
- b. Walter and Dekker (2011).
- c. Seid (2016).
- d. Smits, Huisman, and Kruijff (2008).
- e. Taylor and von Fintel (2016).

- f. Shin and others (2015); Walter and Dekker (2011).
- g. Piper, Zuilkowski, and Ong'ele (2016).
- h. Ethnologue (2015).
- i. Ong'uti, Aloka, and Raburu (2016); RTI International (2016).
- j. Metila, Pradilla, and Williams (2016).

Box 6.4 Using diagnostic data to deliver better learning in Latin America

Mexico's Colima state implemented a learning improvement program in low-performing public schools using student performance on a national exam. Each school was assigned a technical adviser who visited schools three times a month to train teachers on analyzing the test information, as well as on understanding the reasons for poor performance. Based on the analysis, the adviser—working with school directors and teachers—developed a school-specific plan to address identified problems and provided follow-up support during

implementation of the plan. Student performance improved in both language and math, but only several months after the program was launched.^a A similar program in Argentina—distributing reports on the learning outcomes of students to public primary schools to inform teachers of the strengths and weaknesses of their students—also increased learning. Students in those schools reported that their teachers were more active in interacting with students in their classrooms and were less likely to leave early.^b

Source: WDR 2018 team.

- a. de Hoyos, García-Moreno, and Patrinos (2017).
- b. de Hoyos, Ganimian, and Holland (2016).

and language.³² Teaching at the level of the student is not a novel idea, but a range of new evidence is showing how it can be implemented—even at scale—in developing countries.

Teacher motivation and incentives make a difference, even with few inputs

No amount of training or inputs can substitute for teacher motivation. Because of high teacher absenteeism in many countries, fostering effort is a serious challenge. Moreover, even when they are in school, teachers are often not in class teaching. Yet education systems in many countries neither reward

teachers for performing well nor penalize them for performing poorly. Teachers need to be treated as professionals—and good professionals receive support and respect, but are also held to high expectations. A system that does not pay attention to what its teachers are doing does not afford teachers the respect they deserve (box 6.5).

Over the long run, the best way to strengthen teacher ability and motivation may be to attract capable, intrinsically motivated people into the profession. In many countries and economies, the youth who plan to go into teaching are not among the highest academic performers (figure 6.2). In Finland, teaching is a coveted profession, largely because teachers receive great respect, are well trained, are reasonably paid, and have autonomy to implement teaching standards.³³ Across

Box 6.5 Would raising teachers' salaries increase their motivation?

In many countries, teachers are paid less than other comparably educated professionals.^a Would raising their salaries lead to higher motivation and better performance? Indonesia doubled pay for certified teachers, using a randomized controlled trial to evaluate the impact. Doubling

pay increased teacher satisfaction, but it had no effect on either measurable effort or student performance for existing teachers.^b Though higher salaries could attract more capable candidates to the profession over time, raising salaries is no quick fix for shortcomings in motivation or effort.

Source: WDR 2018 team.

a. Mizala and Nopo (2016); OECD (2016a).

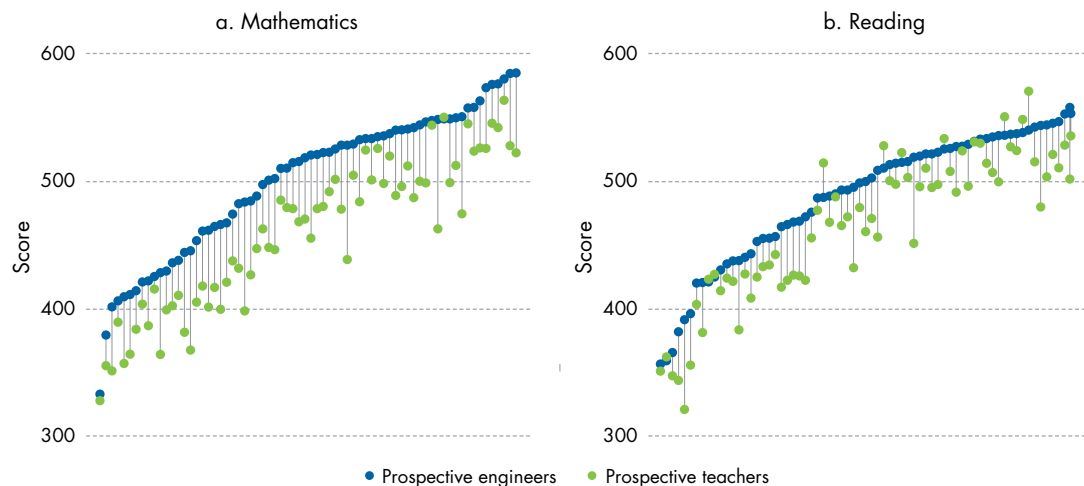
b. de Ree and others (forthcoming).

many countries, average teacher pay has fallen relative to that of other professions. At the same time, the wage distribution in teaching has narrowed. High-ability candidates may be less attracted by a narrow pay structure because it gives them little opportunity to reap professional rewards from high performance.³⁴ Restructuring teacher pay both to remunerate competitively and to provide returns to good performance—whether directly through pay or indirectly through promotion or retention—may improve the quality of candidates entering the teaching profession. But this is a long-term solution, not a quick fix, and even the best candidates need a supportive system to maintain their skills and effort over time.

Better selection and retention policies will result in better teachers. More meritocratic hiring—say, based on a test instead of patronage—could improve student learning.³⁵ One proposal would be to introduce a teaching apprenticeship of three to five years, allowing systems to identify effective teachers.³⁶ The least effective teachers could then be transitioned out of the teaching force. In the United States, proposals to phase out the least effective teachers suggest that the gains to learners over time would be substantial: replacing the least effective 7–12 percent of teachers could bridge the gap between U.S. student performance and that of Finland.³⁷ Estimates of teacher value added in other countries are

Figure 6.2 Prospective engineers typically score higher than prospective teachers on PISA tests

PISA 2015 scores for participating countries and economies, by subject and self-identified prospective occupation



Source: WDR 2018 team, using data from OECD (2016b). Data at http://bit.do/WDR2018-Fig_6-2.

Note: PISA = Programme for International Student Assessment.

comparable, suggesting similarly large gains around the world to improved teacher selection.³⁸

Education systems need to build accountability to align incentives between teachers and others. Teachers have incentives and information that are distinct from those of students, parents, and administrators, and mental models and social expectations affect the decisions of all actors. In the absence of accountability to provide motivation, teachers may minimize their efforts even as learners and parents wish for them to exert more. In Argentina and Uganda, more than one-third of teachers surveyed do not see themselves as responsible for their students' learning; in Senegal, the share is more than half.³⁹

Teacher motivation works through various behavioral mechanisms and comes in multiple forms.⁴⁰ The fact that another person may observe their performance offers a form of professional motivation. So do evaluations, where teachers expect their performance to be assessed, with the associated consequences.⁴¹ Financial incentives for successful teachers and firing

of neglectful ones are just two important parts of a broader spectrum of accountability interventions. At the same time, teachers in many environments face multiple demands beyond teaching, as well as risks such as late payment of salaries and even physical danger (box 6.6). It can be tempting, in light of data on high teacher absenteeism and low teacher skills, to blame teachers for many of the faults of education systems. But these systems often ask far more of teachers than teaching—and at times offer relatively little in return.⁴²

Financial and nonfinancial incentives are one possible mechanism for teacher motivation. In India, students performed better in primary schools that provided teachers with financial incentives for higher reading and mathematics scores.⁴³ Students also scored higher in science and social studies, despite no financial incentives being offered in those areas. Other financial incentive programs were successful in two districts of Kenya and elsewhere in India.⁴⁴ In the United States, by contrast, teacher

Box 6.6 One factor undermining teaching: Poor working conditions

Analyses of the proximate causes of lack of learning in low- and middle-income countries often point to teachers. Evidence suggests that in many countries teachers are absent for an astonishing number of school days and know too little about the subjects they are to teach. For this reason, students and other stakeholders may want and deserve more from teachers—but teachers also deserve more from the systems that employ them.^a Over the last few decades, the status of the teaching profession has declined across the world in terms of pay, respect, and working conditions.^b Because of the rapid expansion in access to education, teachers in developing countries often lead oversized, multigrade classes.^c The teacher shortage increases workloads and requires long working hours, sometimes including double shifts.^d Moreover, teachers often have duties outside classrooms, such as coordinating the activities of parent-teacher associations, running extra-curricular activities, and performing administrative tasks.^e

Teachers in developing countries also face difficult working and living conditions. A lack of school infrastructure and equipment often handicaps their efforts.^f Many teachers take on other jobs to support themselves and their families.^g The situation is even worse for teachers in remote and rural areas, who have to travel long distances to work and collect their salary.^h

And then there are the widely implemented curriculum reforms that require teachers to equip students with new skills and employ better pedagogy, but often without giving teachers sufficient training and supportive teaching materials.ⁱ In such cases, teachers are expected to perform as professionals, but education systems fail to offer them professional development opportunities and create a professional culture for them.^j

Source: WDR 2018 team.

a. Evans and Yuan (2017).

b. Dolton and Marcenaro-Gutierrez (2011); Hammett (2008); Harris-Van Keuren and Silova (2015).

c. Gamero Burón and Lassibille (2016); Guajardo (2011); Ramachandran, Bhattacharjee, and Sheshagiri (2008).

d. Ávalos and Valenzuela (2016); Gamero Burón and Lassibille (2016); Liu and Onwuegbuzie (2012); Luschei and Chudgar (2017); Osei (2006); Urwick and Kisa (2014).

e. Guajardo (2011); Liu and Onwuegbuzie (2012); Luschei and Chudgar (2017).

f. Alcázar and others (2006); Gamero Burón and Lassibille (2016); Urwick and Kisa (2014).

g. Urwick and Kisa (2014).

h. Gamero Burón and Lassibille (2016).

i. Peng and others (2014); Urwick and Kisa (2014).

j. Mooij (2008).

financial incentives did not improve test scores in several states.⁴⁵ However, large financial incentives for teachers did increase student learning in the District of Columbia, United States.⁴⁶ In Mexico and Tanzania, teacher financial incentives were effective only in conjunction with another intervention.⁴⁷ One interpretation of this scattered evidence is that financial incentives are most likely to be effective when teachers can take straightforward actions to improve learning. In environments with high teacher absenteeism from school or from the classroom while at school, it is likely to be clear to teachers that they can improve learning by simply coming to school and spending more time teaching. Alternatively, in environments like that found in the United States where teacher absenteeism is minimal, the specific actions that teachers should take to improve learning may be less obvious and less easy to implement. Nonfinancial incentives may include providing successful teachers with special recognition. Evidence of the effectiveness of these incentives in education is limited, although there is suggestive evidence in other sectors—for example among health workers in Zambia, where public recognition of worker achievement markedly improved performance.⁴⁸

Financial incentives can also create challenges. In Kenya, responding to a student incentive program, teachers taught specifically to the test, potentially neglecting more holistic learning. In a teacher incentive program in Mexican secondary schools, a significant portion of the identified increase in student learning was attributed to student cheating.⁴⁹ In the United States, teacher cheating rose strongly when incentives were increased.⁵⁰ And when teacher incentive programs are removed, the results can also be adverse.⁵¹

With financial incentives, the devil is in the details. Incentives can be based on teacher inputs such as attendance or on outputs such as student learning. They can be based on reaching an absolute level of achievement or on gains. They can be available to all who reach a goal, or they can be competitive across schools. They will vary in size relative to teacher salaries. The evidence on these design elements is still limited, but they merit careful consideration, taking into account local institutions.

Likewise, the precise shape of a system's overall incentive structure will vary by context. In some places, financial incentives may be worth piloting. In others, increased community accountability may be effective. The mixed evidence on these interventions suggests a need to examine carefully the context and to test programs locally. But while details will vary, no education system will be successful unless it provides incentives—whether implicit or explicit—for teacher effort.

* * *

Over time, education systems perform best when their teachers are respected, prepared, selected based on merit, and supported in their work. Countries should work toward these objectives. But in the short run, countries can take actions to strengthen the performance of teachers. They can improve the quality of professional development, shifting resources to the kinds of professional development that will change teacher performance in the classroom. They can support teachers in teaching to the level of the student. They can provide a professional structure so that teachers feel motivated to apply what they know. Teachers are key to learners' education. Making them more effective in both the short and the long run is an excellent investment.

Notes

1. UIS (2017).
2. Bold and others (forthcoming); Tandon and Fukao (2015); World Bank (2016).
3. Bruns and Luque (2015); Mulkeen (2010).
4. Strizek and others (2014).
5. Calderón (2014); World Bank (2014, 2016).
6. Darling-Hammond and others (2009).
7. Hammett (2008); Lauwerier and Akkari (2015).
8. Aaronson, Barrow, and Sander (2007); Buddin and Zammaro (2009); Goldhaber (2007); Rivkin, Hanushek, and Kain (2005).
9. Michaelowa (2001).
10. Popova, Evans, and Arancibia (2016).
11. Walter and Briggs (2012).
12. Darling-Hammond and others (2009); Yoon and others (2007).
13. Kraft, Blazar, and Hogan (2016); Popova, Evans, and Arancibia (2016).
14. Conn (2017).
15. Banerjee and others (2007).
16. Liang, Kidwai, and Zhang (2016).
17. Fryer (2017).
18. Ganimian and Murnane (2016).

19. He, Linden, and MacLeod (2008, 2009); Lucas and others (2014); Spratt, King, and Bulat (2013).
 20. Abadzi and Llambiri (2011); Ciacchio (2004); Leder (1987).
 21. Zuilkowski, Jukes, and Dubeck (2016).
 22. Pritchett and Beatty (2015).
 23. Banerjee and others (2016).
 24. Banerjee and others (2007, 2016); Duflo, Dupas, and Kremer (2011); Kiessel and Duflo (2014); Muralidharan, Singh, and Ganimian (2016).
 25. Cummins (2016); Duflo, Dupas, and Kremer (2011).
 26. Banerjee and others (2016).
 27. Figlio and Page (2002); Lefgren (2004); Zimmer (2003).
 28. Bolyard (2003); Piper and Korda (2010).
 29. OECD (2011).
 30. Aaronson, Barrow, and Sander (2007); Duflo and others (2014); Muralidharan and Sundararaman (2010).
 31. Banerjee and others (2007); Carrillo, Onofa, and Ponce (2010).
 32. Muralidharan, Singh, and Ganimian (2016).
 33. Sahlberg (2011).
 34. Jackson (2012).
 35. Estrada (2016).
 36. Muralidharan (2016).
 37. Hanushek (2011).
 38. Buhl-Wiggers and others (2017).
 39. Sabarwal, Abu-Jawdeh, and Masood (2017).
 40. Gill, Lerner, and Meosky (2016).
 41. Lerner and Tetlock (1999).
 42. Mizala and Ñopo (2016); OECD (2016a).
 43. Muralidharan (2012); Muralidharan and Sundararaman (2011).
 44. Duflo, Hanna, and Ryan (2012); Glewwe, Ilias, and Kremer (2010).
 45. Fryer (2013); Glazerman, McKie, and Carey (2009); Springer and others (2010).
 46. Dee and Wyckoff (2015).
 47. Behrman and others (2015); Mbiti, Muralidharan, and Schipper (2016).
 48. Ashraf, Bandiera, and Jack (2014).
 49. Behrman and others (2015).
 50. Jacob and Levitt (2003).
 51. Jinnai (2016); Visaria and others (2016).
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